

DEVELOPMENT OF GEOGRAPHICAL CONCEPTS  
IN BLIND CHILDREN

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October, 1969

The ability to recognize, identify and discriminate tactile forms, textures and symbols by blind students is regarded as essential for reading embossed maps. The limited quantity of research in map reading is concentrated in these areas. While efforts in tactual perception have undoubtedly contributed to the improvement of embossed maps, researchers have left relatively untouched the development of geographical concepts necessary to interpret these forms, textures and symbols in map reading.

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The value of models, embossed materials and tactile aids in the education of blind children has been recognized for sometime. In the early 1930's, Merry and Merry (1933) explored the ability of the blind child to recognize embossed pictures. Cutsforth (1930) analyzed the relationship between tactual and visual perceptions in sighted college students in an effort to clarify some of the issues on tactual perception. Hayes (1937) attempted to determine the extent of blind students' information in geography and their ability to apply this knowledge.

The 1940's brought broader recognition of the value of models, embossed materials and other tactile aids for the blind. Henderson (1965) reviewed the history of materials and methods of constructing raised line diagrams, including references from the 1930's and 1940's.

Mandola (1967) in reviewing a sampling of the literature of the 1940's found no attempt to support the value of developed aids by empirical evidence or by quoting research studies that might lend support. Validity was based on impressions and opinions of teachers who developed materials and of authors who wrote about them.

The 1950's introduced systematic research into basic problems of tactual perception on a scale that had not previously existed. Studies in tactual perception have continued into the 1960's and have fostered research in map reading. The following are representative areas in which studies have been done:

- 1) Form perception (Schiff & Isakow, 1966; Nolan & Morris, 1960)
- 2) Textures (Heath, 1958; Nolan & Morris, 1963; Schiff, 1965)
- 3) Linear, areal and point symbols (Nolan & Morris, 1963; Schiff, 1965; Pick & Pick, 1966)
- 4) Developmental problems in tactual map design (Sherman, 1964; Wiedel & Groves, 1968; Wiedel, 1969).

The studies referred to herein are indicative of the shifts in emphasis and the refinement in research procedures in map reading over the past twenty-five years. The blind student's need for knowledge in discrimination of forms, textures and symbols used in embossed maps has given direction and emphasis to this research. However, the

necessity of his understanding basic geographical concepts which support the use of these symbols is not in evidence in the research of the majority of those who have pursued these studies.

In his evaluation of the extent of blind students' information in geography, Hayes found the blind testing near the seeing students on geographical information, but decidedly below on map tests. He did not seek to determine the extent of knowledge of basic geographical concepts upon which this geographical information was based. His presentation of the "Hahn-Lackey Standard Test of Geographical Information" is a good illustration of this point. Following are representative exercises taken from the test:

Fourth grade

"Name four continents."

Seventh and eighth grades

"How are valleys made?"

"Name a mountain range and a river between Europe and Asia."

It is assumed that fourth grade students know what a continent is, and that the latter students have adequate concepts of the terms: valley, mountain range and river. This assumption has persisted in education of blind children and is reflected in research in map reading.

## PART I: EXAMINATION OF DIRECTIONAL CONCEPTS

### Purpose

Directional concepts in young blind children (grades two and four) were examined to obtain baseline information prior to administration of a test to explore geographical concepts of blind students.

### Subjects

Five braille students each from grades two and four in three residential schools were tested. The age range for grade two was from 7 to 13 years with an average of 9.3 years. Fourth grade students ranged 9 to 14 years and averaged 10.6 years. IQ scores for grade two students were not always available. Teacher judgment was relied upon in selecting "average" students. Average IQ for the fourth grade group was 99.7.

### Materials

The directional concepts test was structured to gain information on knowledge of general directions, including left/right (Section I), and north, east, south, and west directions (Section II). General directional words were drawn from the grade one and two sections of the Dolch word list. A copy of test follows.

## DIRECTIONAL CONCEPTS NECESSARY FOR MAP READING

Sample: Ask the student to find the line at the center of the globe. \_\_\_\_\_  
Show him this line in relation to the United States.  
This is the point from which he will begin the remaining tasks.

### Directional words -- general, right and left

Using your right hand, follow the line around the globe. right \_\_\_\_\_  
around \_\_\_\_\_

Place your right hand on the top of the globe. top \_\_\_\_\_

Put your left hand under the bottom of the globe. left \_\_\_\_\_  
under \_\_\_\_\_

Which hand is up, the right or left hand? bottom \_\_\_\_\_  
up \_\_\_\_\_

Which hand is down, the right or left hand? down \_\_\_\_\_

Move your right hand to the center of the globe. to \_\_\_\_\_  
Stop at the line.

Did you move your hand up or down to reach the center up \_\_\_\_\_  
line? down \_\_\_\_\_

Now place your right hand with your palm down on the globe. down \_\_\_\_\_

Put your left hand on your right hand. on \_\_\_\_\_

Move your left hand away. away \_\_\_\_\_

Now place your left hand by your right hand by \_\_\_\_\_

### North, east, south, west

If you move your hand toward the top of the globe, are you moving it north or south? \_\_\_\_\_

When you move your hand from the top of the globe to the line at the center, are you moving your hand north, east, south, or west? \_\_\_\_\_

If you move your hand along the line toward the right, are you moving it north, east, south, west? \_\_\_\_\_

If you move your hand along the line toward the left, are you moving it north, east, south, west? \_\_\_\_\_

From the center of the globe, move your hand in the following directions: north east south west  
\_\_\_\_\_



### Procedure

The exercises require the blind student to demonstrate or show the direction on a globe indicated by the directional words in each item. The 12 inch Geo-physical Globe, American Printing House, was used. The examiner read each item to the student, and recorded his response on an answer sheet.

### Results

Second and fourth grade students had little difficulty in indicating general directions using the globe. Right and left directions, although indicated with occasional hesitation by the grade two students, posed little problem. Results were 100% on performance of these tasks.

North, south, east and west directions were more difficult for students to demonstrate. Grade four students achieved a performance of 86.6%, while grade two students achieved only 41.6%. Results are given in Table 1.

TABLE I

Directional Concepts		
<u>Grade</u>	<u>Section I</u>	<u>Section II</u>
2	100%	41.6%
4	100%	86.6%

Results indicated that grade four students had sufficient knowledge of general direction, left/right and north, east, south and west to constitute the lower grade used in testing geographical concepts.

## PART II: DEVELOPMENT OF GEOGRAPHICAL CONCEPTS

### Purpose

It was the purpose of this study to explore geographical concepts of blind children. This exploration was of a general nature. No attempts were made to evaluate or discriminate whether responses of students were on concrete, functional or abstract levels.

### Subjects

A total of 75 blind students from four residential schools, fifteen from grades 4, 6, 8, 10 and 12, were used in the study. Students were selected randomly in the 80 - 120 IQ range. A few students below and above this range were included because of insufficient numbers available within the 80 - 120 range. IQ's for the total group ranged from 76 to 139. Regularly enrolled students under the age of 21 were accepted. Ages ranged from nine to twenty years. Ages of students at each grade level varied from three to six years. Age and IQ averages for the grade groups are presented in Table 2.



TABLE 2

Average Age and IQ for the Total Sample

<u>Grade</u>	<u>Mean Age</u>	<u>Mean IQ</u>
4	10.6	99.7
6	14.3	98.5
8	15.1	100.6
10	16.3	110.4
12	18.2	112.5

### Materials

Through curriculum analysis 70 basic geographical terms used in map reading were identified from fourth, fifth and sixth grade test-books and materials. Six sets of social studies textbooks and more than one dozen sets of map reading materials for sighted students were examined. A test, structured in three sections, was developed using these 70 terms. Section I of the test corresponds roughly to those geographical terms appearing at grade four; Section II, corresponds to those terms at grade five; and Section III, corresponds to those terms at grade six. Most of the terms appeared in graded texts published by Follett Publishing Company, Chicago.

Lists of the geographical terms which composed the test are given in Table 3.

Table 3

## Basic Geographical Terms

<u>Section I</u>	<u>Section II</u>	<u>Section III</u>
ocean	current	basin
mountain	delta	canal
lake	divide	cape
island	downstream	dike
canyon	elevation	fiord
gulf	glacier	foothills
equator	iceburg	marsh
highland	isthmus	monsoon
continent	jungle	rapids
channel	mountain peak	reef
coast	peninsula	savanna
valley	port	steppe
hill	river basin	tundra
forest	sound	inlet
swamp	source (of a river)	llano
plateau	strait	pampa
plain	timber line	rain forest
desert	tributary	oasis
prairie	tropics	latitude
reservoir	volcano	longitude
bay	North Pole	
river	South Pole	
seashore	Antarctic	
arctic	mouth (of a river)	
harbor	mountain range	

Procedure

The test consisting of 70 terms was administered orally to each student. The student was given a braille copy of each section which he could follow as the examiner read aloud the list of terms. The examiner recorded each response on an answer sheet. Responses were recorded and rated 0, 1 and 2. The 2 rating represents an "adequate" operational concept which includes a definition and at least one descriptive response. The 1 rating indicates a partial concept consisting of either definition or description.

TABLE 4

## Discrimination of Geographical Terms

<u>Grade</u>	<u>Mean Scores</u>		
	<u>Section I</u> <u>(50 points)</u>	<u>Section II</u> <u>(50 points)</u>	<u>Section III</u> <u>(40 points)</u>
4	27.7	14.1	4.5
6	37.1	27.3	13.2
8	32.2	23.5	12.8
10	41.7	34.8	21.9
12	37.9	30.0	20.1

Table 5 presents the percentage of geographical terms at each grade level for which the average was one or more than one on a two-point scale. Percentages are given for each section and for overall.

TABLE 5

## Percent of Geographical Terms Recognized

<u>Grade</u>	<u>Section I</u> <u>(25 words)</u>	<u>Section II</u> <u>(25 words)</u>	<u>Section III</u> <u>(20 words)</u>	<u>Overall</u> <u>(70 words)</u>
4	55%	28%	11%	33%
6	74%	55%	33%	55%
8	64%	47%	32%	48%
10	83%	70%	55%	70%
12	76%	60%	50%	63%

The highest group performance was achieved by the tenth grade with an overall score of 70%. This score is relatively low. It indicates that the highest scoring group was able to define or explain less than three-fourths of the geographical terms drawn from fourth, fifth and sixth grade social studies curriculum and materials.

Although no word analysis was made, an inspection of the social studies and science curriculum indicates that repetition of many of the terms occur at certain grade levels. Table 6 was constructed in an effort to determine the effect of repetition on overall scores.

TABLE 6  
Effect of Repetition on Overall Scores

<u>Grade</u>	<u>Overall Scores</u>	<u>Differences</u>
4	33%	
6	55%	+ 22%
8	48%	- 7%
10	70%	+ 22%
12	63%	- 7%

The overall score for the grade six group is 7% higher than for the grade eight group. The sixth grade curriculum provides repetition for fourth and fifth grade terms, as well as providing additional terms at the sixth grade level during the year the study was made.

The 0 rating indicates either an incorrect response or no response.

The following example illustrates the procedure used.

Examiner: "What is an ocean?"

Student: "An ocean is a large body of water." (definition, 1 point)

Examiner: "Can you tell me something more about an ocean?"

Student: "It is salty." (description, 1 point)

The student would receive a total of 2 points for these responses. If he had given additional information, his rating still would be 2.

## Results

Results indicate that the three levels of terms used in the test do discriminate among grade groups. Namely, terms in Section I are recognized by more students in each grade than terms in Section II. More terms in Section II are recognized by more students in each grade than terms in Section III. Results of this part of the study are given in Table 4.

Scores for the tenth grade group at 7% higher than for the twelfth grade group. There is repetition of many of the terms in ninth and tenth grade social studies. In ninth and tenth grade science there is a re-introduction of many of the terms in such new contexts as physical and earth science.

From sixth to eighth grade and from tenth to twelfth grade--periods when there appears to be less repetition of terms--scores tend to drop.

Ages and IQ's were examined to determine if part of the results attributed to repetition were in fact due to age and/or IQ. Table 7 compares age, IQ and overall scores.

TABLE 7

Age, IQ and Overall Scores Compared

<u>Grade</u>	<u>Mean Age</u>	<u>Mean IQ</u>	<u>Overall Scores</u>
4	10.6	99.7	33%
6	14.3	98.5	55%
8	15.1	100.6	48%
10	16.3	110.4	70%
12	18.2	112.5	63%



The greatest age difference occurs between grades four and six with an increase of 3.7 years for the interval. The 22% difference in scores may be related to the age differences and grade levels in the following ways:

1. The amount of age increase,
2. The 3.7 years age increase may occur during a critical learning period,
3. Many of the geographical terms are introduced for the first time in grade four,
4. Many other terms are repeated and concepts expanded during grades four and five,
5. Considerable repetition and introduction of new terms occur during a period immediately preceding the testing period.

The 22% increase in overall score by the grade ten group over the grade eight group appears to be more influenced by repetition in curriculum and by the 10 point greater IQ than by the small increase in age.

It is interesting to note that at grade levels six to eight and ten to twelve where overall scores decrease, age and IQ increase.

Since increases in IQ and performance are not consistent in Table 7, differences in IQ and differences in performance among groups were subject to question.

The three grades with highest overall scores--grades six, ten and twelve--were selected to determine if differences in IQ exist among these groups. The Kruskal-Wallis One-Way Analysis of Variance was used to test for differences because of the small number of students in each grade group and because of the heterogeneous nature of the sample. Results were significant at the .01 level indicating that the groups differ significantly with respect to IQ.

The same test was used with these groups to determine differences in overall scores among the groups. Results were significant at the .01 level, indicating that the groups do differ with respect to their performance on the test.

As a point of interest, the examples cited from Hayes' study on geographical information are repeated here. Data from this study is given for the geographical terms in the examples to suggest the effect that lack of adequate geographical concepts might have on performance scores on a test of geographical information.

Fourth grade

"Name four continents." Fourth grade students in this study achieved only 40% performance on the term continent.

Seventh and eighth grades

"How are valleys made?"

"Name a mountain range and a river between Europe and Asia."

Table 8 presents the percentages of responses on the above geographical terms from data in this study.

TABLE 8

Responses on Geographical Terms

<u>Term</u>	<u>Fourth</u>	<u>Sixth</u>	<u>Eighth</u>	<u>Tenth</u>	<u>Twelfth</u>
valley	57%	77%	60%	90%	83%
mountain range	03%	60%	50%	77%	60%
river	67%	87%	73%	90%	87%

Hayes found the blind testing near the sighted on geographical information. Should the information in Table 8 be representative of the knowledge of geographical concepts of the students in his study, one would question Hayes' findings. The assumption that blind students comprehend underlying geographical concepts is reflected in all the studies cited. Neither does any study cited indicate an awareness of the concept level at which the population tested functions.

## Conclusions

1. A number of the geographical concepts tested are relatively unknown at several grade levels.
2. Higher scores at some grade levels appear to be a result of repetition of terms in curriculum content, especially in social studies and science.
3. Generally, increased repetition of terms appeared to contribute to higher overall gains.
4. Overall gains due to repetition were short-lived and decreased when repetition was reduced.
5. Gains acquired through much repetition and re-introduction of terms in different contexts were greater, but also diminished noticeably over relatively short periods of time.
6. The presence of a pattern of increased learning through repetition is supported by the data presented.

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1. Ocean. Oceans are the largest bodies of water on the earth. Can you find (identify) the ocean area on the land form?

2. Island. An island is a body of land completely surrounded by water. It is smaller than a continent. Find the island on the landform.

3. Lake. An inland body of water surrounded by land is called a lake. Find the lake on the land form.

4. Coast. Land by an ocean or sea is <sup>its</sup> the coast. <sup>A coast</sup> It may be level or raised land. Find the coast on the land form. (also called coastline, sea coast)

5. Seashore. The seashore is level or sandy land beside the sea or ocean. Show how "coast" and "seashore" may differ on the land form.

6. Hill. A hill is a raised part of the earth's surface that is smaller than a mountain. Point out a hill on the land form.

7. Mountain. A mountain is higher than a hill. It is rocky land, usually with steep sides and a pointed or rounded top. Find a mountain.

8. Valley. A valley is a low stretch of land between hills or mountains. Find a valley.

9. Canyon. A canyon is a deep narrow valley with steep sides. Find a canyon. Show the difference between a canyon and a valley on the land form.

10. Reservoir. <sup>man-made</sup> A/lake where water is stored, usually held by a dam, is called a reservoir. Find the reservoir on the land form.

11. Basin. A basin is an area of land enclosed by higher land. A basin is similar to a valley on the landform. Find a basin.

12. Plain. An area which is mostly flat, low land is called a plain. Find a plain on the land form.

13. Prairie. A prairie is a kind of grassy plain. <sup>a plain and a prairie will appear the same on the landform.</sup> Find an area on the land form that could be a prairie.

14. Plateau. <sup>mountain</sup> A plateau is a kind of plain ~~that is high, usually~~ with steep sides. It is like a mountain with a level or table top. Find the plateau.



15. Channel. A body of water, usually deep and narrow, connecting two larger bodies of water is called a channel. Find a channel.

16. Canal. A man-made channel used for transportation ~~(or irrigation)~~ is a canal. Find a canal. A canal and a channel may appear the same on a map or land form.

4 ? 17. Bay. The part of a body of water that reaches into the land is a bay. Find a bay.

18. Gulf. A large area of the ocean partially enclosed by land, and larger than a bay, is called a gulf. Can you find a bay and a gulf on the land form?

19. Harbor. A harbor is a protected place used as a shelter for ships. Can you find a place on the land form where a harbor might be located?

20. Port. A port is a place where ships can load and unload their cargoes. Find a place on the land form where a port could be located.

21. River. A river is a large stream of water which flows <sup>downstream</sup> through the land. Find a river on the land form.

22. Tributary. A river or stream that flows into a larger <sup>river</sup> ~~body of water~~ is a tributary. Can you find a tributary on the land form?

23. Source of a river. The source of a river is the place where the river begins. Follow a river to its source, or as nearly as possible to its source.

5 24. Mouth of a river. The place where a river flows into a larger body of water is called its mouth. Follow a river to its mouth on the land form. ?

25. River basin. Land drained by a river and its branches is called a river basin. Can you find an area on the land form that might be a river basin?

26. Delta. Land deposited at the mouth of a river is a delta. Find the delta area on the land form.

27. Volcano. A mountain that has been formed by molten lava that has been thrown up from inside the earth is a volcano. Locate the volcano on the land form.

28. Mountain peak. The top of a mountain is a mountain peak. Find one on the land form.

29. Mountain range. A mountain range is a row of mountains. Can you find a mountain range on the land form?

30. Highland. A highland is high or mountainous land. Find such an area on the land form.

31. Foot hills. Foot hills are low hills at or near the base of mountains. Locate some foot hills on the land form.

32. Divide. A divide is a height of land which separates river basins. Can you locate a divide on the land form?

33. Timberline. A timberline is an imaginary line on a mountain above which no trees will grow because of the cold. Can you locate a place on the land form which might represent a timberline?

34. Peninsula. A peninsula is a <sup>long</sup> body of land surrounded on three sides by water. ~~Find the peninsula on the landform.~~

35. Cape. A cape is a point of land sticking out into a body of water. Find a peninsula and a cape on the landform.

36. Isthmus. An isthmus is a narrow strip of land connecting two larger bodies of land. Can you find the isthmus?

37. Strait. A narrow stretch of water which connects two larger bodies of water is called a strait? Find the strait on the landform.

38. Sound. A sound is a body of water separating one or more islands from the mainland. Find the sound on the landform.

39. Inlet. A narrow strip of water extending into the land is an inlet. There are several inlets on the landform. Locate one.

40. Dike. A dike is man-made wall of earth or stone which keeps water from flooding the land. Can you find the dike?

Harley (1963) Verbalism as defined in this study occurred when a child gave an acceptable definition of a word but could not accurately identify the object symbolized by the word by some sensory means.

Harley suggests two possible alternatives for reducing verbalism among blind children:

- a) control vocabulary in educational materials for the blind
- b) increase the ability of the blind child to identify objects represented by words in his vocabulary

...Blind children need a unique program in order to help them learn simple concepts that sighted children have developed through incidental learning.

### Conclusions

1) The primary purpose of this study was to develop a short group test which would measure basic geographical concept attainment of visually handicapped students similar to, if not the equivalent of, the original test.